road construction, quarrying, and coastal development, this appears to be a significant overestimate of wetland loss. Further investigation is needed to clarify overall wetland status for Mackinac County. As with other Michigan counties, there has clearly been a net loss of conifer swamp acreage in the county, owing to drainage and conversion to other wetland types. Emergent wetlands also appear to have declined in acreage relative to historical estimates. Given the apparent distortions current acreage estimates, it is difficult to reach definite conclusions about the magnitude of these changes.

Marquette

Exposed bedrock knobs and areas with thin till over bedrock characterize large parts of northern Marquette County. Although bedrock generally controls topography in these areas, the character of the topography is variable. In some areas the terrain is a mosaic of low rocky ridges less than 50 ft. high, with many small lakes and swamps. In other areas, like the Huron Mountains, large, exposed ridges of granite or sandstone can be 300-500 ft. high. There are large areas of sandy ground moraine scattered throughout the county. The Yellow Dog and the Mulligan plains, two large outwash plains, separated by only a few miles, occur within the county. Extensive outwash plains are also located at Gwinn, and southwest of Ishpeming.

The soils of the county are generally sands. Local silt caps of aeolian origin covers some of the rock knobs. The tops of the bedrock knobs have little or no soil. All of the soils are very acid. The soils on the two outwash plains are excessively drained sands. Near Gwinn, there are numerous kettle lakes and depressions, some containing ponds and peat deposits. Farther to the south, the outwash slopes gradually to the southeast where acid peat deposits lay over sand or sandy loam. Poorly drained soils of the county are classified as the Angelica-Trenary-Onaway-Carbondale association, or the Newton-Saugatuck-Rubicon association.

In the 1840s, areas of thin soils over bedrock in Marquette County included extensive forests of hemlock, sugar maple, white pine, yellow birch, white spruce, and balsam fir, in varying combinations. Mixed pine forests were common on sandy outwash plains and sand lake plain. Sugar maple-basswood forest was found on ground moraine in the southwest portion of the county. Historical estimates of wetland extent for the county indicate that there were about 284,000 acres of wetlands comprising 24% of the county surface. Mixed conifer swamp, with varying amounts of cedar, tamarack, and black spruce were by far the dominant wetland type in the county. Mixed conifer swamp and alder-willow swamp was found in narrow ravines between bedrock ridges throughout the north half of the county. Great Lakes marsh and tamarack swamp were common in several embayments along the Lake Superior shoreline. Coastal dune and swale complexes are located at Little Presque Isle, Big Bay, Iron River, the mouth of the Salmon Trout River, and at the Pine River mouth. The complex at Big Bay was mostly bog and tamarack swamp, while the one at Salmon Trout Bay was dominated by cedar and white pine and bog inland, and alder-willow swamps closer to the shoreline. More extensive swamps of similar composition were found on extensive peat deposits at the southern end of the county. These swamps were typically dominated by balsam fir, tamarack, and black spruce.

Comparison of historical data with MIRIS estimates indicates a net wetland loss of 6% for Marquette County. That represents the drainage or inundation of about 17,000 wetland acres, mostly associated with the Dead River Storage Basin, the Silver Lake Basin, and other reservoirs, as well as with road construction and urban development around the City of Marquette. As with other northern counties, there has clearly been a significant conversion of mixed conifer swamp to other wetland types. Roughly 106,000 acres of conifer swamp has been drained or converted to other wetland types. Lowland hardwoods, shrub swamps, and emergent wetlands all show acreage increases, relative to historical estimates.

Menominee

The surface geology of Menominee County includes medium-textured ground moraine, sand lake plain, outwash deposits, and areas with thin till over bedrock. The ground moraine dominates the central portion of the county. This area contains the most extensive drumlin fields in the state. The soils of the drumlin fields vary in drainage characteristics based on topographic position. Moderate to steep slopes of the drumlins are mostly well drained, while the lowlands between the drumlins are poorly drained, supporting muck and peat deposits. Soils of the drumlin fields are classified as the Onaway-Lupton association. Sand lake plain is concentrated in a 1-5 mile band along the Lake Michigan shoreline. Soils of this flat landscape are generally poorly drained, classified